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Abstract

South-central Kentucky has one of the world's most intensively studied karst areas, with most work focusing on the Mammoth Cave System and the related aquifers within the Mississippian St. Louis, Ste. Genevieve and Girkin Limestones. Within much of the Mammoth Cave Plateau, these limestones are overlain by the Big Clifty Sandstone and other formations that form a protective caprock within the area's major ridges. Above the Big Clifty, in turn, is the Mississippian Haney Limestone, typically about 12 m thick, which forms a locally important but much less well studied carbonate aquifer. This research provides the most comprehensive hydrogeologic synthesis to date of the karst hydrogeology of the Haney Limestone within south-central Kentucky, in the present study including Warren, Hart and Edmonson Counties.

Analysis of landforms, surface and subsurface drainage, and karst features shows that there is a range of karstification intensities across formation outcrop areas. A total of ninety-three caves and forty-nine springs were identified within the study area. Known caves are not evenly distributed, with relatively high densities within Mammoth Cave National Park, where there is long history of systematic exploration and documentation of caves by the Cave Research Foundation, and near Bowling Green where there is a relatively high number of cavers. This suggests that more caves are likely to be found in areas that have not been as thoroughly investigated.

Recharge forming Haney Caves is largely allogenic where the formation's upper contact with Hardinsburg Sandstone is exposed and concentrates flow, at sinkholes that breach the Hardinsburg or within downcutting stream valleys. Other recharge lands directly onto the Haney karst surface on localized sinkhole plains, or leaks as diffuse flow through the overlying Hardinsburg. Conduit morphology and development have been strongly influenced by joints in the bedrock and passage characteristics suggest little phreatic influence on conduit enlargement.

Cave entrances are frequently perennial spring resurgences and the high proportion of active streams suggests that the caves are a function of the current landscape, acting as drains for localized recharge areas. This suggests that caves in the Haney Limestone were not directly influenced by the incision of the Green River in a way similar to Mammoth Cave, but that cave development is a much more recent and local process.

The most significant cave in the study area is Cub Run Cave in Hart County, with more than two kilometers of mapped passages, most of which is a large trunk along the main stream. The cave occupies the full thickness of the Haney, with both the overlying Hardinsburg visible in the ceiling at places, as well as a shale layer at the Haney/Big Clfty contact below. An upper section of the cave's northwest extent continues upward through the Hardinsburg and into the overlying Glen Dean Limestone. Although groundwater tracing would be necessary to carefully constrain the cave's recharge area, based on apparently topographic divides on the Hardinsburg it is about 1.7 km2. This apparently small catchment suggest that the large passages (up to 15 meters in diameter) may result more from a long period of dissolution that a large contributing area.